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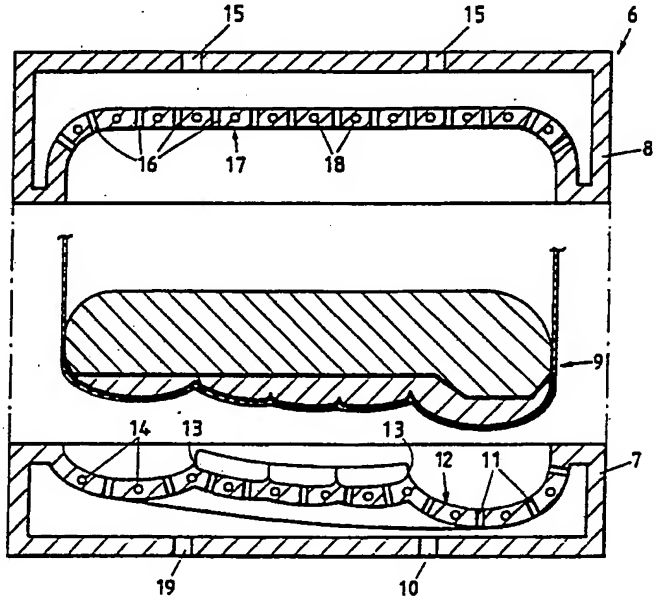
(54) Title: METHOD FOR MANUFACTURING A CUSHION WHICH IS AT LEAST COMPOSED OF A BODY, AN INTERMEDIATE FOAM LAYER AND AN UPHOLSTERY LAYER



(57) Abstract

The invention relates to a method for manufacturing a cushion (9) which is at least composed of a steam permeable body (1), a mainly open cellular intermediate layer (2) and an upholstery layer (3), in which method the intermediate foam layer (2) is impregnated with a steam curable reaction mixture, the upholstery layer (3), the intermediate foam layer (2) and the body (1) are placed in a mould (6) having a first (7) and a second (8) gas permeable mould part, the upholstery layer (3) is sucked against the first mould part (7) and steam is injected through the second mould part (8) at such a temperature and for a sufficient time so that at least the intermediate foam layer (2) would be deformed substantially permanently, the upholstery layer (3) being sucked at least during a predetermined length of time against the first mould part (7) simultaneously with injecting said steam through the second mould part (8).

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"Method for manufacturing a cushion which is at least composed of a body, an intermediate foam layer and an upholstery layer".

This invention relates to a method for manufacturing a cushion which is in particular destined for car seats and which is at least composed of a steam permeable body, a mainly open cellular intermediate foam layer and an upholstery layer, which method comprises the steps of :

a) impregnating the intermediate foam layer with a steam curable reaction mixture ;

b) placing the upholstery layer, the intermediate foam layer and the body in such a manner in a mould, comprising at least a first and a second mutually cooperating gas permeable mould parts, that both layers and the body are located along each other, the intermediate foam layer being placed between the body and the upholstery layer and this upholstery layer being placed along said first gas permeable mould part and the body along said second gas permeable mould part ;

c) exerting a pressure upon the totality of said layers and said body placed along each other in said mould so as to deform at least the intermediate foam layer ; and

d) injecting through at least one of both mould parts steam at such a temperature and for a sufficient time so as to deform the intermediate foam layer substantially permanently.

Such a method is disclosed in French Patent Application FR-A-2 540 427. In this known method, one or more impregnated pieces of synthetic foam are placed in a two-piece mould together with an upholstery layer of fabric. After closing this mould, steam is injected herein through both mould parts in order to deform the pieces of synthetic foam permanently and in order to fix them together.

A drawback of this known method is that it appeared to be unsuitable when a sharply profiled mould is used, for example

to realize a grooved outer surface, and this especially in combination with a relatively little flexible upholstery layer.

An object of the invention is now to provide a method which remedies this drawback and which enables therefore to manufacture a sharply profiled cushion even with upholstery layers which are hard to deform.

To this end, the upholstery layer is sucked against the first mould part and said steam is injected through the second mould part, the upholstery layer being sucked at least during a predetermined length of time against the first mould part simultaneously with injecting said steam through the second mould part.

Sucking the upholstery layer against the first mould part enables to fit even upholstery layers which are more difficult to deform in a simple way against this first mould part. In order to prevent the upholstery layer from becoming possibly detached again from the first mould part on certain places, this upholstery layer is still sucked during a certain time against the first mould part while steam is already injected into the mould through the second mould part. In this way, it is therefore possible to maintain the upholstery layer even during the action of the steam in the desired shape, possibly even until the reaction mixture is cured and the cushion has obtained therefore a substantially permanent shape.

In a preferred embodiment of the method according to the invention a substantially gas impermeable thermoplastic synthetic film is placed between the upholstery layer and the intermediate foam layer. By means of this film applied onto the upholstery layer, it is even possible to suck very gas permeable upholstery layers against the first mould part. Preferably, use is made of a synthetic film which is transformed by the action of the steam into a steam permeable adhesive layer which allows to adhere the upholstery layer to the intermediate foam layer.

In a preferred embodiment of the method according to the invention, use is made of a body which is mainly composed of a mainly open cellular non-impregnated synthetic foam which has been shaped previously. This body can be shaped previously in a mould

or can be cut roughly out of a block of synthetic foam. Possibly, the body can also be composed of different layers, for example layers of different foam quality, such as different hardnesses, or a combination of synthetic foam layers with other steam permeable materials. The choice of the different layers allows also to determine the properties of the final product. These layers have to be fixed, for example glued, to each other. An advantage of the method according to the invention is that this body itself has not to be permanently deformable since the intermediate foam layer is provided for the shaping. The synthetic foam of the body keeps its initial properties as this foam has not been impregnated.

In a suitable embodiment of the method according to the invention, the first mould part is preheated upto a temperature of 90 to 150°C and preferably upto a temperature of about 100°C. An important advantage hereof is that at this higher temperature the upholstery layer is easier to deform. Too high temperatures, however, may damage the upholstery layer, for example for temperature sensitive fabric types.

Further particularities and advantages of the invention will become apparent from the following description of a method for manufacturing a cushion according to the invention. This description is only given by way of example and does not limit the scope of the invention. The reference numerals relate to the annexed drawings wherein :

Figure 1 shows schematically a cross-section of different elements which allow to manufacture a cushion, more particularly a back of a car seat, by the method according to the invention ; and

Figure 2 shows a cross-section through an open mould wherein a cushion has been manufactured by the method according to the invention starting from the elements represented in Figure 1.

In these two figures, the same reference numerals relate to the same elements.

The invention relates broadly to a method for

manufacturing a cushion comprising at least a steam permeable body 1, a mainly open cellular intermediate foam layer 2 and an upholstery layer 3. Between the body 1 and the intermediate foam layer 2 and between the latter and the upholstery layer, an adhesive layer 4 and 5 respectively may be provided. This adhesive layer 5 can be composed for example of a thermoplastic synthetic film 5 which is transformed by the action of steam into a sticky adhesive layer.

In the method according to the invention, use is made of a mould 6 wherein the body 1, the intermediate foam layer 2 and the upholstery layer 3 are fixed to each other and wherein mainly the intermediate foam layer 2 and the upholstery layer 3 are permanently deformed. In order that the intermediate foam layer 2 would keep its deformation, this layer 2 is impregnated first with a steam curable reaction mixture. To this end, use can be made for example of a liquid reaction mixture having free NCO-groups and corresponding to one of the following types :

- liquid polyisocyanates and/or polyisocyanate derivatives, possibly diluted with organic diluents ;
- aqueous emulsions of water-emulsifiable polyisocyanates and/or polyisocyanate derivatives ;
- liquid prepolymers of polyols and isocyanates and/or isocyanate derivatives, possibly diluted with organic diluents, and
- aqueous emulsions of water-emulsifiable prepolymers of polyols and isocyanates and/or isocyanate derivatives.

Several additives such as flame retardants, plasticizers and inhibitors can also be added to this reaction mixture. Further, use can be made of a reaction mixture comprising an aqueous solution or emulsion of reactive precondensates of a thermosetting melamin-formaldehyde resin, urea-formaldehyde resin and/or phenol-formaldehyde resin. The latter reaction mixtures have already as such good fire resistant properties.

Figure 2 shows schematically a vertical cross-section through a two-piece mould 6 which is mounted in a non represented press, in its open position.

This mould 6 includes two mutually movable parts

7 and 8, between which a cushion 9 consisting of the elements represented in Figure 1, is formed.

The lowermost or first mould part 7 consists of a hollow body wherein a vacuum can be created through an opening 10 in order to suck a layer which is placed on the mould surface 12 against the latter through hòles 11 which are uniformly distributed over this mould surface 12. The mould surface 12 of the lowermost mould part 7 shown in Figure 2 is sharply profiled and is in particular provided with raised ridges 13. This mould surface 12 comprises further also channels 14 for a heating liquid which allow to preheat the mould part 7 upto a temperature of 90 to 150°C and more in particular to a temperature of about 100°C.

The uppermost or second mould part 8 consists, as well as the lowermost mould part 7, of a hollow body wherein steam can be introduced through openings 15, which steam leaves this mould part 8 then through a series of holes 16 which are uniformly distributed over the mould surface 17 of this second mould part. This mould surface 17 comprises also channels 18 for a heating liquid, which allow to preheat the uppermost mould part 8 preferably upto a temperature of 110° to 180°C and more in particular upto a temperature of 140 to 150°C.

In the method according to the invention, the upholstery layer 3 is placed upon the mould surface 12 of the preheated lowermost mould part 7 and sucked by means of the vacuum created in this lowermost mould part 7 against the latter.

In most cases, it is required to apply a substantially gas impermeable synthetic film 5 onto the upholstery layer 3 in order to enable that the upholstery layer 3 is sucked sufficiently strongly against the mould surface 12, for example when the upholstery layer 3 is permeable itself. The upholstery layer 3 can consist for example of a woven fabric, against which is possibly applied previously a thin backing layer of synthetic foam. The synthetic film 5 is preferably thermoplastic and this in such a manner that it melds away under the action of steam and is transformed into an adhesive layer.

The impregnated intermediate foam layer 2 and

the body 1 are then placed onto the layers 3, 5 which fit closely against the mould surface 12, after which the mould 6 is closed.

In a variant embodiment, the upholstery layer 3, the intermediate foam layer 2 and the body 1 can possibly be placed together into the mould 6.

By closing the mould 6, a pressure is exerted onto the superimposed layers 2, 3 and the body 1 so that at least the intermediate foam layer 2 is deformed onto the body 1. The thickness of the materials placed in the mould 6 can decrease hereby upto 10 %. In some cases, however, it can be provided that the thickness remains substantially unchanged. In order to deform the layers 2, 3 and possibly the body 1 substantially permanently, steam is injected through the uppermost mould part 8 pressed against the body 1, which steam has to penetrate into the intermediate foam layer 2.

The body 1 can be composed of a rigid material which is sufficiently porous or wherein holes are provided in order to allow the steam to pass with a relatively small resistance. However, the body 1 is preferably made of a mainly open cellular synthetic foam which does not necessarily has to be thermically deformable and which has therefore not to be impregnated so that this foam keeps its initial properties. This is clearly not so for the cushions according to FR-A-2 540 427 wherein all pieces of synthetic foam are impregnated so that they become for example less flexible. The synthetic foam can be for example polyurethane foam. In order to obtain certain so called comfort properties, the hardness of the synthetic foam of the body 1 is preferably larger than the hardness of the intermediate foam layer 2.

The steam has to be injected at such a temperature and for a sufficient time in order that the reaction mixture, the intermediate foam layer 2 is impregnated with, would react in order to provide the intermediate foam layer 2 with a substantially remaining deformation. According to the invention, superheated steam at a temperature of 120 to 200°C and preferably of 150 to 170°C is suited hereto. The use of steam in combination with an impregnation allows to obtain quickly a remaining deformation and this at relatively low

temperatures which are not detrimental for the upholstery layer 3 nor for the body 1. It has been found that the minimum required time of steam injection is usually comprised between 5 and 60 seconds and that in most of the cases about 30 seconds are sufficient in order to obtain the desired results.

According to the invention, the upholstery layer 3 is sucked for a certain time against the lowermost mould part 7 during the injection of the steam so as to prevent this upholstery layer 3 from coming loose locally from the lowermost mould part 7 and from taking in this way a not desired shape. This is true as well when a thermoplastic synthetic film 5 is applied onto the upholstery layer 3 or not. In case use is made of a thermoplastic synthetic film 5, which is transformed by the action of the steam into a steam permeable adhesive layer, the vacuum is preferably maintained, even after this transformation, so as to enable to remove the steam through the openings 11 of mould part 7.

The action of the steam causes not only a substantially permanent deformation of the upholstery layer 3, the intermediate foam layer 2 and possibly the body 1 but also an activation of the adhesive layers 4 and 5 in order to glue the hereinbefore mentioned layers 2 and 3 and the body 1 against each other. In some cases, the reaction mixture, the intermediate foam layer 2 is impregnated with, provides already for a sufficient adhesion so that no additional adhesive layers are required.

Appropriate adhesive layers which can provide for the necessary adhesion between the different composing elements of the obtained cushion are firstly thermoplastic hot melt films or powders based on thermoplastic polymers, such as polyolefins, EVA, polyesters, polyamides and polyurethanes having a suitable melting point for example of between 80 and 180°C. Further, there are also suitable liquid thermoplastic or thermosetting glues which are either or not dissolved in an aqueous or in an organic solvent, as well as the one or two components reactive glues.

After the steam injection, the cushion is cooled down for example by sucking away ambient air through the lowermost

part 7 or by blowing pressurized air into the cushion through the uppermost mould part and by sucking this air away through the lowermost mould part.

In a more efficient embodiment, the cushion is however cooled down by means of pressurized air which is introduced through an opening 19 into the lowermost mould part 7 and which is sent through the formed cushion through the holes 13 into the lowermost mould surface 11. During this cooling phase, the cushion 9 cools down and the possible adhesive layers solidify. As the temperature of the lowermost mould part is lower than the temperature of the uppermost mould part and as the pressurized air reaches the adhesive layers and the impregnated intermediate foam layer quicklier through the lowermost mould part, the duration of the cooling phase can be limited by using the pressurized air to about 10 seconds. After the cooling phase, the mould 6 is opened in order to remove the manufactured cushion.

Hereinafter is given further an example wherein a back cushion for a car seat is prepared by means of the mould 6 represented in figure 2.

In this example, use is made of the following materials :

for body 1 : polyether foam of medium hardness and having a density of 18 kg/m³

for the intermdiate foam layer 2 : polyether foam of soft quality having a density of 23 kg/m³

for the upholstery 3 : polyester seat fabric

as reaction mixture : 36.4 parts of polyol (Tercarol 2)
24.6 parts of isocyanate (44V40) (Bayer Product)
30 parts of thinner (1,1,1 trichloroethane)

Firstly, the temperature of the uppermost mould part 8 is adjusted at 140°C and the temperature of the lowermost mould part 7 at 95°C. The upholstery layer 3 and the synthetic film or adhesive layer 5 (type : polyamide glue Platilon H2 - Atochem) are then applied onto this lowermost mould part 7 and are sucked against this mould part 7. Next, the intermediate foam layer 2, having the thickness of 30 mm and which has been impregnated per m³ with an amount of the reaction mixture comprising 5 kg of dry substance

(5 kg/m³ dry pick-up), the adhesive layer 4 and the body 1 are placed in the mould 6, which takes about 30 seconds.

After placing these materials, the mould 6 is closed which takes about 5 seconds.

Then, superheated steam at 160°C is injected through the uppermost mould part 8 for about 30 seconds. During this steaming, a vacuum is still maintained in the lowermost part 7 so that after the adhesive layers 4 and 5 are molten, the steam is sucked away through this lowermost mould part 7.

In the following cooling phase of about 10 seconds, pressurized air is blown into the formed cushion through the lowermost mould part 7.

Opening the mould and demoulding takes each time about 5 seconds so that the whole cycle is completed already in about 85 seconds.

It will be clear that the invention is in no way limited to the hereinabove described embodiments but that these embodiments can be modified in many ways within the scope of the present invention.

As upholstery layer, use can for example possibly be made of a previously manufactured cover wherein the body and different layers are applied before placing them as a whole into the mould.

Further, it is also possible to provide additional steam permeable layers, for example against the back side of the body.

In this body may also be provided reinforcement elements such as for example a tube frame.

CLAIMS

1. A method for manufacturing a cushion (9) which is in particular destined for car seats and which is at least composed of a steam permeable body (1), a mainly open cellular intermediate foam layer (2) and an upholstery layer (3), which method comprises the steps of :

a) impregnating the intermediate foam layer (2) with a steam curable reaction mixture ;

b) placing the upholstery layer (3), the intermediate foam layer (2) and the body in such a manner in a mould (6), comprising at least a first (7) and a second (8) mutually cooperating gas permeable mould parts, that both layers (2,3) and the body (1) are located along each other, the intermediate foam layer (2) being placed between the body (1) and the upholstery layer (3) and this upholstery layer (3) being placed along said first gas permeable mould part (7) and the body (1) along said second gas permeable mould part (8) ;

c) exerting a pressure upon the totality of said layers (2,3) and said body (1) placed along each other in said mould (6) so as to deform at least the intermediate foam layer (2) ; and

d) injecting through at least one of both mould parts (7,8) steam at such a temperature and for a sufficient time so as to deform the intermediate foam layer (2) substantially permanently, characterized in that the upholstery layer (3) is sucked against the first mould part (7) and said steam is injected through the second mould part (8), the upholstery layer (3) being sucked at least during a predetermined length of time against the first mould part (7) simultaneously with injecting said steam through the second mould part (8).

2. A method according to claim 1, characterized in that a substantially gas impermeable thermoplastic synthetic film (5) is placed between the upholstery layer (3) and the intermediate foam layer (2).

3. A method according to claim 2, characterized in that said synthetic film (5) is transformed by the action of the steam into a steam permeable adhesive layer so as to adhere the

upholstery layer (3) to the intermediate foam layer (2).

4. A method according to any one of the claims 1 to 3, characterized in that said body (1) is mainly composed of a mainly open cellular non-impregnated synthetic foam (1) which has been preshaped.

5. A method according to any one of the claims 1 to 4, characterized in that said intermediate foam layer (2) has a hardness smaller than the hardness of the body (1).

6. A method according to any one of the claims 1 to 5, characterized in that the upholstery layer (3) is deformed against the first mould part (7) by said suction before placing the intermediate foam layer (2) and the body (1) into the mould.

7. A method according to any one of the claims 1 to 6, characterized in that said first mould part (7) is provided on its side directed towards the other mould part (8) with ridges (13) which are pressed into the intermediate foam layer (2) when exerting said pressure.

8. A method according to any one of the claims 1 to 7, characterized in that said first mould part (7) is preheated upto a temperature of 90 to 150°C and preferably upto a temperature of about 100°C.

9. A method according to any one of the claims 1 to 8, characterized in that said second mould part (8) is preheated upto a temperature of 110 to 180°C and preferably upto a temperature of 140 to 150°C.

10. A method according to any one of the claims 1 to 9, characterized in that said upholstery layer (3) is a fabric provided with a thin backing layer of a mainly open cellular synthetic foam.

11. A method according to any one of the claims 1 to 10, characterized in that use is made of a liquid reaction mixture containing free NCO-groups and corresponding to one of the following types :

- liquid polyisocyanates and/or polyisocyanate derivatives, possibly diluted with organic diluents ;
- aqueous emulsions of water-emulsifiable polyisocyanates and/or

polyisocyanate derivatives ;

- liquid prepolymers of polyols and isocyanates and/or isocyanate derivatives, possibly diluted with organic diluents, and
- aqueous emulsions of water-emulsifiable prepolymers of polyols and isocyanates and/or isocyanate derivatives.

12. A method according to any one of the claims 1 to 10, characterized in that use is made of a liquid reaction mixture comprising an aqueous solution or emulsion of reactive precondensates of a thermosetting melamin-formaldehyde resin, urea-formaldehyde resin and/or phenol-formaldehyde resin.

13. A method according to any one of the claims 1 to 12, characterized in that super-heated steam is injected at a temperature of 120 to 200°C and preferably at a temperature of 150 to 170°C.

14. A method according to any one of the claims 1 to 13, characterized in that said steam is injected during 5 to 60 seconds and preferably during about 30 seconds.

15. A seat, in particular a car seat, obtained by the method according to any one of the claims 1 to 14.

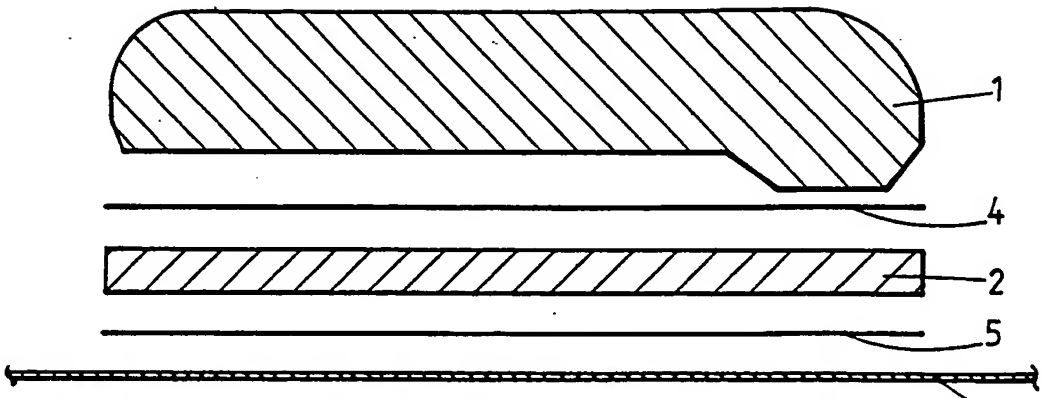

Fig.1

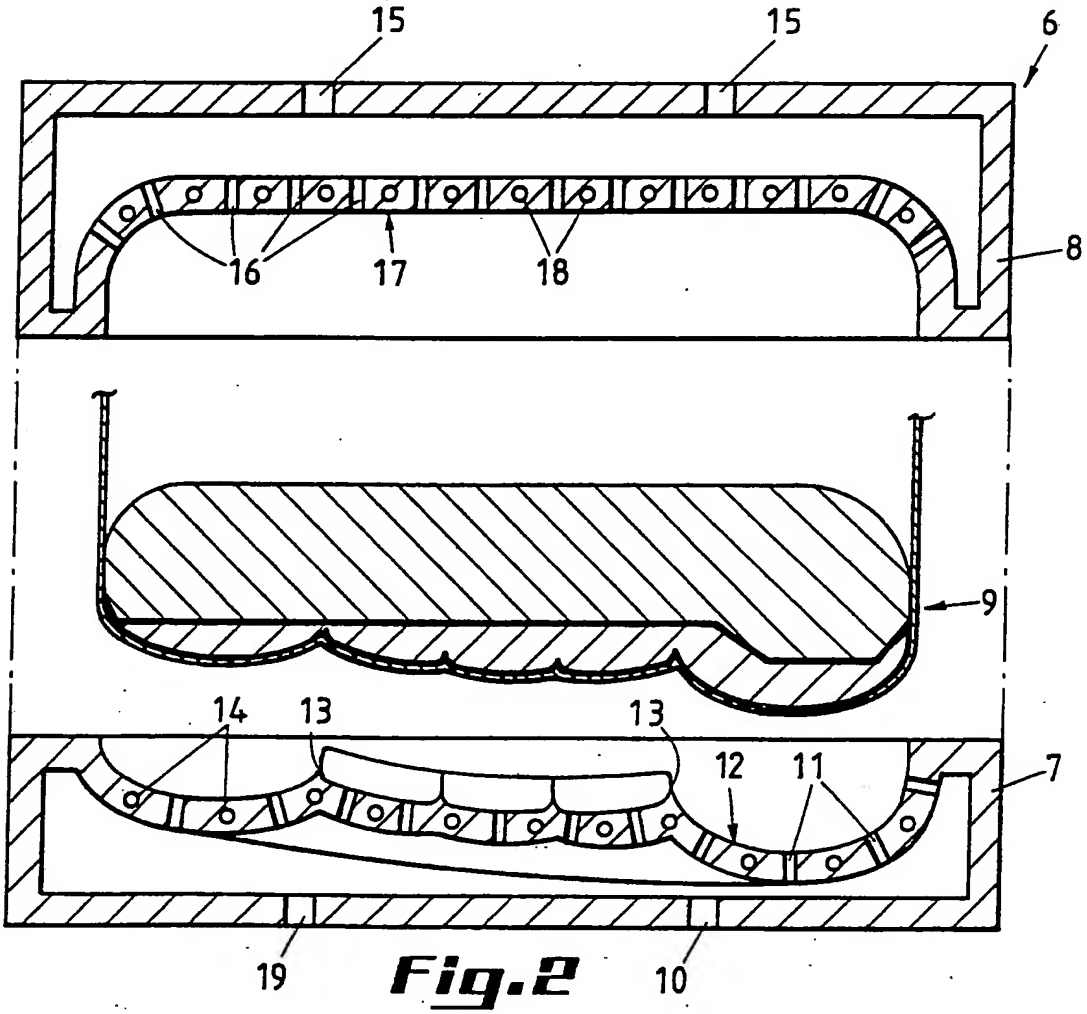

Fig.2

INTERNATIONAL SEARCH REPORT

International Application No PCT/BE 91/00081

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B29C67/22; B29C63/22; B29C69/00; B68G7/05
// B29L31:58

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B29C ; C08J ; B68G

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
Y	US,A,3 801 244 (EISENBERG) 2 April 1974 see the whole document; in particular: column 1, line 61 - column 2, line 9; column 4, lines 24 - 52; figures 1-7	1-15
Y	EP,A,0 323 530 (STEELCASE INC.) 12 July 1989 see the whole document; in particular: column 1 lines 12 - 26; column 3 lines 1 - 12; column 12 line 29 - column 14 line 50; claims 1-5, 14, 18-30, 33	1,3-5, 7-10, 13-15
Y	EP,A,0 227 202 (LEAR SIEGLER INC.) 1 July 1987 see column 5, line 35 - column 6, line 9; claims 1-3,7-12	1-4,6, 8-10, 13-15

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° Special categories of cited documents :[10]

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
07 FEBRUARY 1992	14 FEB 1992
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	Branko Bufacchi

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	FR,A,2 540 427 (SANSON) 10 August 1984 cited in the application see page 3, line 4 - line 20 see page 4, line 32 - page 5, line 18; claims 2,3; figure 9	11,13-15
Y	WO,A,8 801 565 (ASTECHNOLOGIES INC.) 10 March 1988 see amended claims 1-3, 21-25	12-14
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. BE 9100081 SA 53611

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 07/02/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-3801244	02-04-74	None		
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